WHAT IS CLAMED IS:

1. A propylene polymer having:

(1) a 25°C hexane soluble content (H25) of 0-80 wt%; and,

(2) either no melting temperature (Tm) measurable by differential scanning calorimetry (DSC), or a melting temperature (Tm) satisfying, if measurable by DSC, the following relationship:

$$\Delta H \geqq 3 \times (Tm - 120).$$

wherein ΔH is a melting endotherm (J/g).

2. The propylene polymer according to claim 1, having a fraction (W25) eluted at a temperatures up to 25°C by temperature-programmed chromatography, of from 20-100 wt%.

3. A propylene homopolymer satisfying:

(1) a mesopentad fraction (mmmm) of 30-60 mol%;

(2) a racemic pentad fraction (rrrr) satisfying the following relationship:

$$[rrrr/(1-mmmm)] \leqq 0.1$$

(3) a fraction (W25) eluted at a temperatures up to 25°C by temperature-programmed chromatography, of from 20-100 wt%; and,

(4) a pentad fraction (rmrm) of more than 2.5 mol%.

4. The propylene homopolymer according to claim 3, satisfying the following relationship:

$$(mm) \times (rr)/(mr)^2 \leqq 2.0$$

wherein (mm) is a meso triad fraction; (rr) is a racemic triad fraction; and (mr) is a triad fraction.

5. The propylene homopolymer according to claim 3, having a molecular weight distribution (Mw/Mn) of 4 or less as measured by gel permeation chromatography (GPC) and/or an intrinsic viscosity [η] of from 0.5-15.0 dl/g as measured at 135°C in tetralin.

6. A propylene copolymer satisfying:

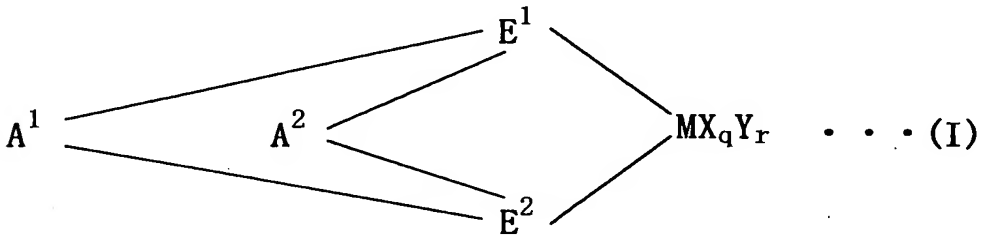
(1) a stereoregularity index (P) of 55-90 mol% as determined by ^{13}C-NMR measurement; and

(2) a fraction (W25) eluted at a temperatures up to 25°C by temperature-programmed chromatography, of from 20-100 wt%.

7. The propylene copolymer according to claim 6 having a molecular weight distribution (Mw/Mn) of 4 or less as measured by gel permeation chromatography (GPC) and/or an intrinsic viscosity [η] of from 0.5-15.0 dl/g as measured at 135°C in tetralin.

8. The propylene homopolymer according to claim 3 produced by polymerizing propylene in the presence of a polymerization catalyst containing:

(A) a transition metal compound represented by the general formula (I):



$$\cdots (I)$$

wherein M is a metal element of Groups 3 to 10 of the Period Table or lanthanoid series;

E^1 and E^2 are respectively a ligand selected from the group consisting of substituted cyclopentadienyl, indenyl, substituted indenyl, heterocyclopentadienyl, substituted heterocyclopentadienyl, amide, phosphide, a hydrocarbon group and a silicon-containing group, which form a cross-linked structure via A^1 and A^2 and may be the same or different;

X is a ligand capable of forming a 刧-bond or π-bond with the proviso that when a plurality of X groups are present, these groups may be the same or different, and may be cross-linked with the other X group, E^1, E^2 or Y;

Y is a Lewis base with the proviso that when a plurality of Y groups are present, these groups may be same or different, and may be cross-linked with the other Y group, E^1, E^2 or X;

A^1 and A^2 are divalent cross-linking groups capable of bonding the two ligands E^1 and E^2 to each other, are respectively a C_1-C_{20} hydrocarbon group, a C_1-C_{20} halogen-containing hydrocarbon group, a silicon-containing group, a germanium-containing group, a tin-containing group, -O-, -CO-, -S-, $-SO_2-$, -Se-, $-NR^1-$, $-PR^1-$, $-P(O)R^1-$, $-BR^1-$ or $-AlR^1-$ wherein R^1 is a hydrogen atom, a halogen atom, a C_1-C_{20} hydrocarbon group or a C_1-C_{20} halogen-containing hydrocarbon group, and may be the same or different;

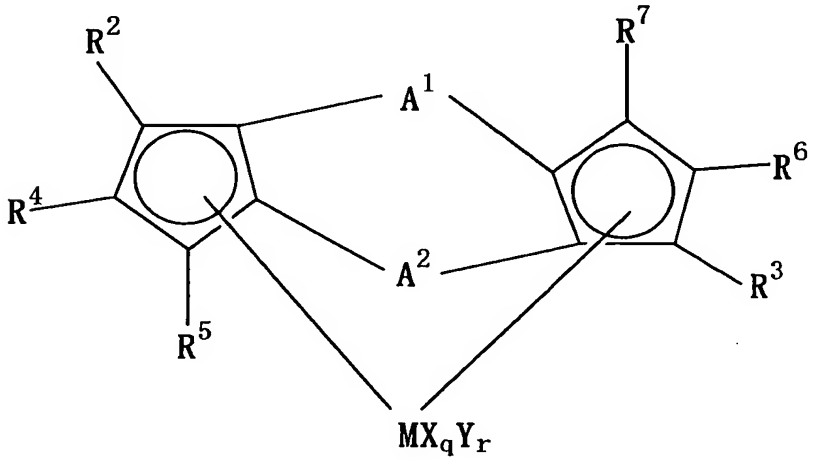
q is an integer of 1 to 5 given by the formula:

[(valence of M) - 2]; and

r is an integer of 0 to 3, and

(B) a component selected from the group consisting of (B-1) a compound capable of forming an ionic complex by reacting with the transition metal compound (A) or a derivative thereof, (B-2) aluminoxane, and (B-3) a Lewis acid.

9. The propylene homopolymer according to claim 8, wherein the transition metal compound represented by the general formula (I) is a transition metal compound represented by the general formula (II):

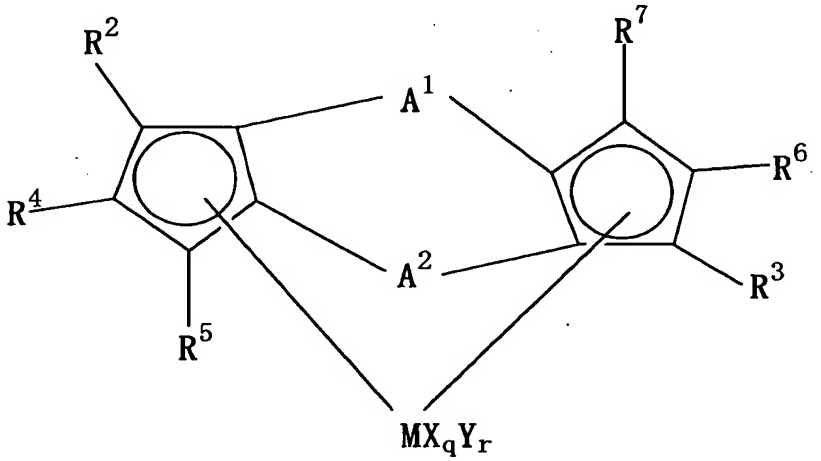


• • • (II)

wherein, M, X, Y, A^1, A^2, q and r are the same as defined in the above general formula (I); R^2 through R^7 are respectively a hydrogen atom, a halogen atom, a C_1-C_{20} hydrocarbon group, a C_1-C_{20} halogen-containing hydrocarbon group, a silicon-containing group or a heteroatom-containing group with the proviso that at least one of R^2 through R^7 is not a hydrogen

atom; and R^2 through R^7 may be the same or different, and adjacent groups of R^2 through R^7 may be bonded to each other to form a ring.

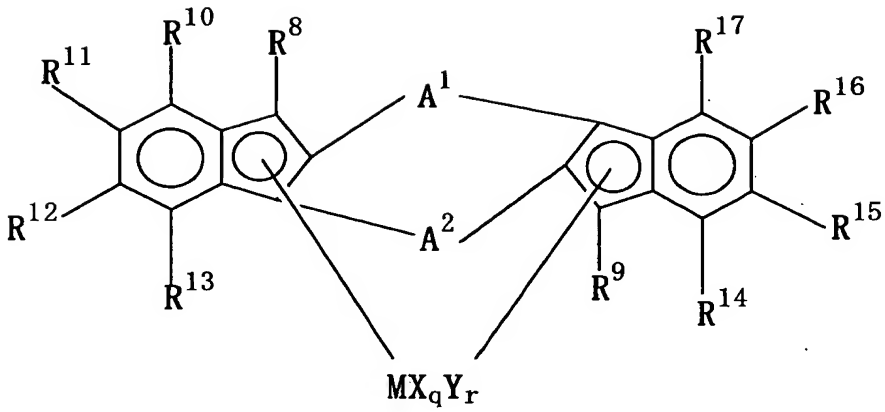
10. The propylene homopolymer according to claim 8, wherein the transition metal compound represented by the general formula (I) is a transition metal compound represented by the general formula (II):



. . . (II)

wherein, M, X, Y, A^1, A^2, q and r are the same as defined in the above general formula (I); R^2 through R^7 are respectively a hydrogen atom, a halogen atom, a C_1-C_{20} hydrocarbon group, a C_1-C_{20} halogen-containing hydrocarbon group, a silicon-containing group or a heteroatom-containing group with the proviso that at least one of R^2 through R^7 is a group containing a heteroatom such as oxygen, halogen or silicon; and R^2 through R^7 may be the same or different, and adjacent groups of R^2 through R^7 may be bonded to each other to form a ring.

11. The propylene homopolymer according to claim 9, wherein the transition metal compound represented by the general formula (II) is a transition metal compound represented by the general formula (III):

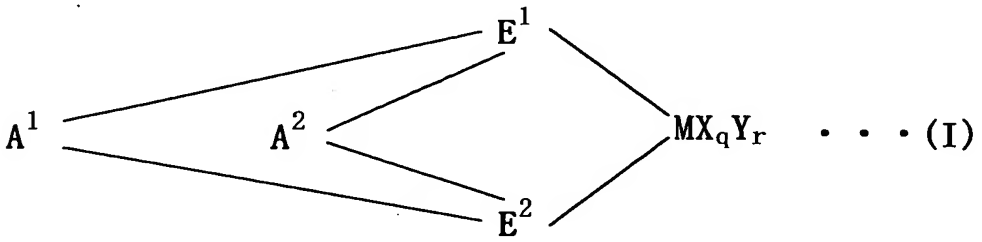


• • • (III)

wherein, M, X, Y, A^1, A^2, q and r are the same as defined in the above general formula (I); at least one of R^8 and R^9 represents a group containing a heteroatom such as oxygen, halogen or silicon; and R^{10} through R^{17} are respectively a hydrogen atom, a C_1-C_{20} hydrocarbon group, or a group containing a heteroatom such as oxygen, halogen and silicon.

12. The propylene copolymer according to claim 6 produced by copolymerizing propylene with ethylene and/or a C_4-C_{20} α-olefin in the presence of a polymerization catalyst comprising:

(A) a transition metal compound represented by the general formula (I):



• • • (I)

wherein M is a metal element of Groups 3 to 10 of the Period Table or lanthanoid series;

E^1 and E^2 are respectively a ligand selected from the group consisting of substituted cyclopentadienyl, indenyl, substituted indenyl, heterocyclopentadienyl, substituted heterocyclopentadienyl, amide, phosphide, a hydrocarbon group and a silicon-containing group, which form a cross-linked structure via A^1 and A^2 and may be the same or different;

X is a ligand capable of forming a 刼-bond or π-bond with the proviso

that when a plurality of X groups are present, these groups may be the same or different, and may be cross-linked with the other X group, E^1, E^2 or Y;

Y is a Lewis base with the proviso that when a plurality of Y groups are present, these groups may be same or different, and may be cross-linked with the other Y group, E^1, E^2 or X;

A^1 and A^2 are divalent cross-linking groups capable of bonding the two ligands E^1 and E^2 to each other, are independently a C_1-C_{20} hydrocarbon group, a C_1-C_{20} halogen-containing hydrocarbon group, a silicon-containing group, a germanium-containing group, a tin-containing group, -O-, -CO-, -S-, -SO_2-, -Se-, -NR^1-, -PR^1-, -P(O)R^1-, -BR^1- or -AlR^1- wherein R^1 is a hydrogen atom, a halogen atom, a C_1-C_{20} hydrocarbon group or a C_1-C_{20} halogen-containing hydrocarbon group, and may be the same or different;

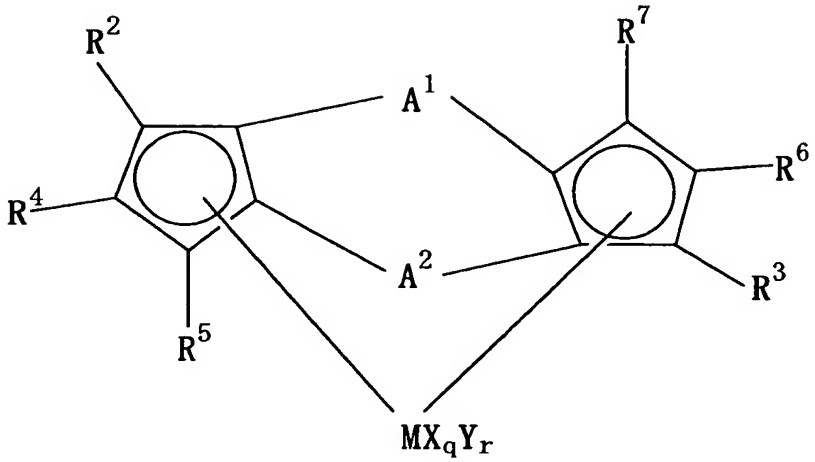
q is an integer of 1 to 5 given by the formula:

[(valence of M) - 2]; and

r is an integer of 0 to 3, and

(B) a component selected from the group consisting of (B-1) a compound capable of forming an ionic complex by reacting with the transition metal compound (A) or a derivative thereof, (B-2) aluminoxane, and (B-3) a Lewis acid.

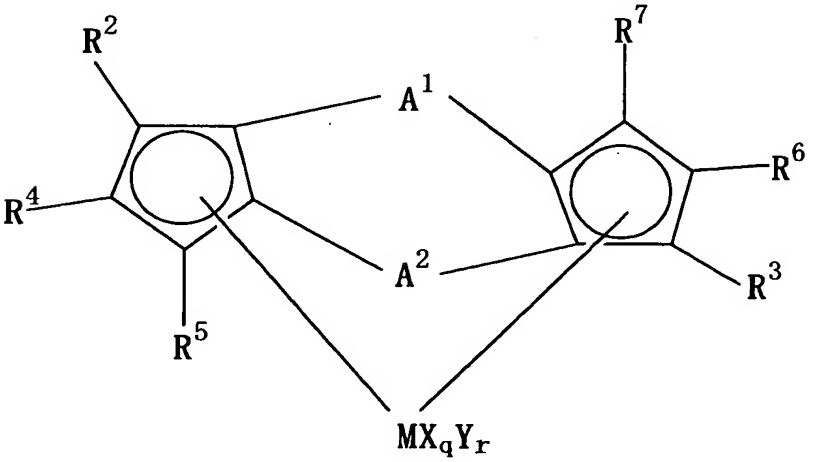
13. The propylene copolymer according to claim 12, wherein the transition metal compound represented by the general formula (I) is a transition metal compound represented by the general formula (II):



• • • (II)

wherein, M, X, Y, A^1, A^2, q and r are the same as defined in the above general formula (I); R^2 through R^7 are respectively a hydrogen atom, a halogen atom, a C_1-C_{20} hydrocarbon group, a C_1-C_{20} halogen-containing hydrocarbon group, a silicon-containing group or a heteroatom-containing group with the proviso that at least one of R^2 through R^7 is not a hydrogen atom; and R^2 through R^7 may be the same or different, and adjacent groups of R^2 through R^7 may be bonded to each other to form a ring.

14. The propylene copolymer according to claim 12, wherein the transition metal compound represented by the general formula (I) is a transition metal compound represented by the general formula (II):

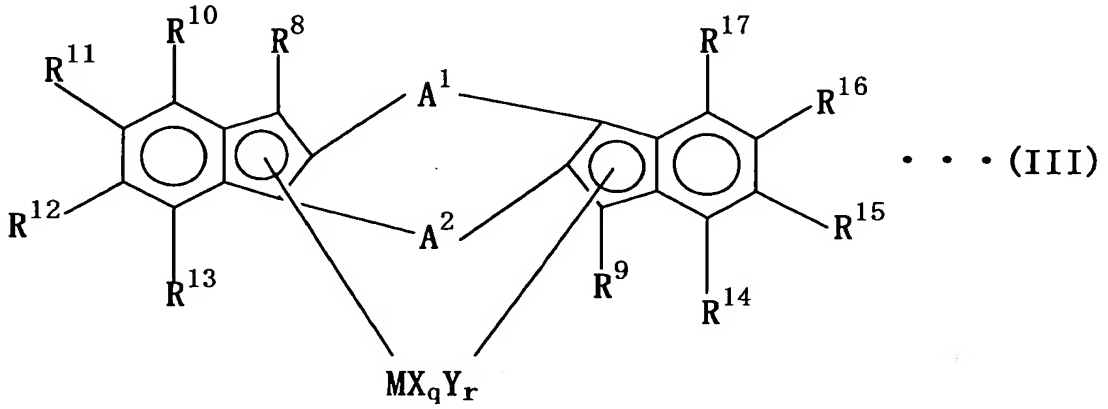


• • • (II)

wherein, M, X, Y, A^1, A^2, q and r are the same as defined in the above general formula (I); R^2 through R^7 are respectively a hydrogen atom, a

halogen atom, a C_1-C_{20} hydrocarbon group, a C_1-C_{20} halogen-containing hydrocarbon group, a silicon-containing group or a heteroatom-containing group with the proviso that at least one of R^2 through R^7 is a group containing a heteroatom such as oxygen, halogen or silicon; and R^2 through R^7 may be the same or different, and adjacent groups of R^2 through R^7 may be bonded to each other to form a ring.

15. The propylene copolymer according to claim 13, wherein the transition metal compound represented by the general formula (II) is a transition metal compound represented by the general formula (III):



• • • (III)

wherein, M, X, Y, A^1, A^2, q and r are the same as defined in the above general formula (I); at least one of R^8 and R^9 represents a group containing a heteroatom such as oxygen, halogen or silicon; and R^{10} through R^{17} are respectively a hydrogen atom, a C_1-C_{20} hydrocarbon group, or a group containing a heteroatom such as oxygen, halogen and silicon.

16. A propylene resin composition comprising the propylene polymer according to claim 1 and a nucleating agent.

17. A propylene resin composition comprising the propylene homopolymer according to claim 3 and a nucleating agent.

18. A propylene resin composition comprising the propylene copolymer according to claim 6 and a nucleating agent.

19. A molded product produced by molding the propylene polymer according to claim 1.

20. A molded product produced by molding the propylene resin composition according to claim 16.

21. A molded product produced by molding the propylene homopolymer according to claim 3.

22. A molded product produced by molding the propylene resin composition according to claim 17.

23. A molded product produced by molding the propylene copolymer according to claim 6.

24. A molded product produced by molding the propylene resin composition according to claim 18.

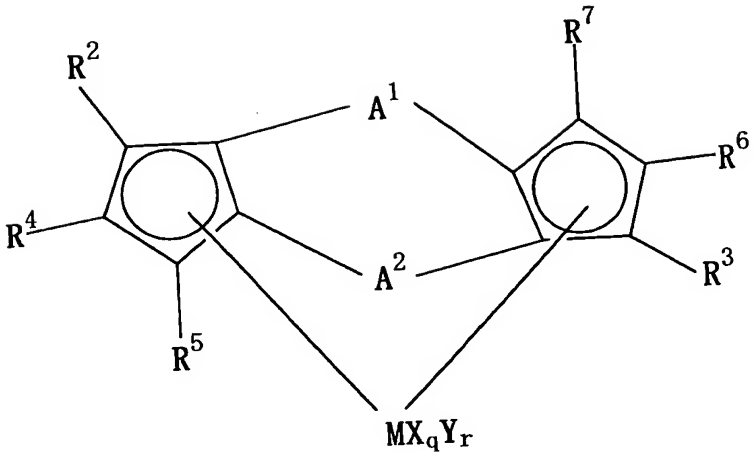
25. A propylene resin modifier comprising the propylene polymer according to claim 1.

26. A propylene resin modifier comprising the propylene homopolymer according to claim 3.

27. A propylene resin modifier comprising the propylene copolymer according to claim 6.

28. A polymerization catalyst comprising:

(A') a transition metal compound represented by the general formula (II):



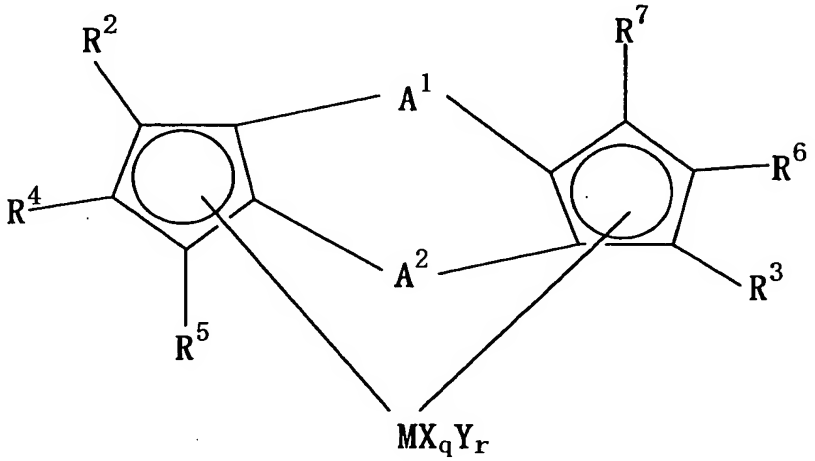
. . . (II)

wherein, M, X, Y, A^1, A^2, q and r are the same as defined in the above general formula (I); R^2 through R^7 are respectively a hydrogen atom, a halogen atom, a C_1-C_{20} hydrocarbon group, a C_1-C_{20} halogen-containing hydrocarbon group, a silicon-containing group or a heteroatom-containing group with the proviso that at least one of R^2 through R^7 is not a hydrogen atom; and R^2 through R^7 may be the same or different, and adjacent groups of R^2 through R^7 may be bonded to each other to form a ring, and

(B) a component selected from the group consisting of (B-1) a compound capable of forming an ionic complex by reacting with the transition metal compound (A) or a derivative thereof, (B-2) aluminoxane, and (B-3) a Lewis acid.

29. A polymerization catalyst comprising:

(A') a transition metal compound represented by the general formula (II):



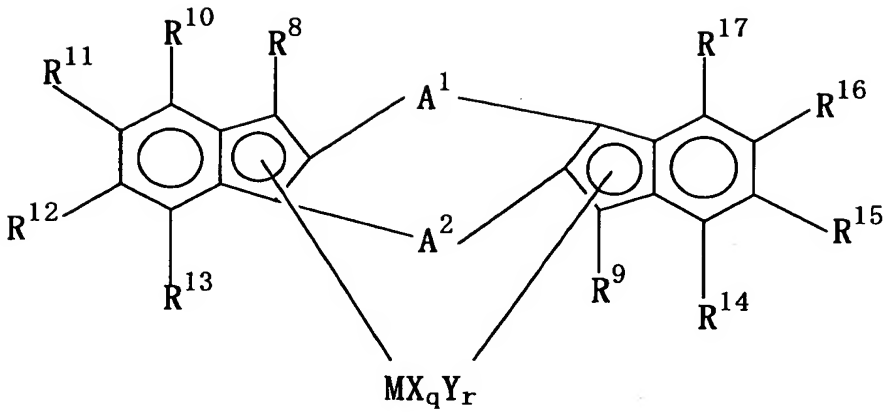
• • • (II)

wherein, M, X, Y, A^1, A^2, q and r are the same as defined in the above general formula (I); R^2 through R^7 are respectively a hydrogen atom, a halogen atom, a C_1-C_{20} hydrocarbon group, a C_1-C_{20} halogen-containing hydrocarbon group, a silicon-containing group or a heteroatom-containing group with the proviso that at least one of R^2 through R^7 is a group containing a heteroatom such as oxygen, halogen or silicon; and R^2 through R^7 may be the same or different, and adjacent groups of R^2 through R^7 may be bonded to each other to form a ring, and

(B) a component selected from the group consisting of (B-1) a compound capable of forming an ionic complex by reacting with the transition metal compound (A) or a derivative thereof, (B-2) aluminoxane, and (B-3) a Lewis acid.

30. A polymerization catalyst comprising:

(A") a transition metal compound represented by the general formula (III):



• • • (III)

wherein, M, X, Y, A^1, A^2, q and r are the same as defined in the above general formula (I); at least one of R^8 and R^9 represents a group containing a heteroatom such as oxygen, halogen or silicon; and R^{10} through R^{17} are respectively a hydrogen atom, a C_1-C_{20} hydrocarbon group, or a group containing a heteroatom such as oxygen, halogen and silicon, and

(B) a component selected from the group consisting of (B-1) a compound capable of forming an ionic complex by reacting with the transition metal compound (A) or a derivative thereof, (B-2) aluminoxane, and (B-3) a Lewis acid.